

decomposition of manganiferous silicates in crystalline rocks. The second type includes bedded ores; their manganese was derived from the silicates of crystalline rocks, and was deposited in the sedimentary rocks and then concentrated; this group includes the Appalachian ores, the most important in the United States. The two last groups comprise the manganese minerals associated with the silver ores of Leadville and other western mining fields, and the deposits with the Jurassic radiolarian jasperoids of California, which, according to Prof. Lawson, were deposited by suboceanic springs.

The chapter on the protean chemistry and uses of manganese describes the introduction of manganese steel in consequence of Hadfield's discovery that though the addition of 5 per cent. of manganese renders steel brittle and useless, the presence of about 12 per cent. produces a metal so hard, tough, and nonmagnetic that it has very important industrial applications.

Maine and New Hampshire are States in which mining is of secondary importance, but Mr. W. H. Emmons' short and interesting bulletin shows that ore deposits occur which have some features in common with those in the adjacent provinces of Canada. The geology is well known from Hitchcock's memoir and the later researches of Dr. G. O. Smith. The valuable minerals include gem-bearing pegmatites, which are not described in this bulletin, and some pyritic veins and ores of lead, zinc, silver, copper, and molybdenum. The basement of the area consists of metamorphic rocks, which are regarded as probably Archean; they are succeeded by sediments and volcanic rocks attributed to the Cambrian; the volcanic rocks were followed or accompanied by some igneous intrusions, beside which ores were formed as contact deposits. These rocks were then crushed to schists, at a date which is pre-Silurian, "but how much older is not known." Granitic intrusions followed in the Devonian.

The most interesting ores are the pyritic bodies, which here, as in other cases, give clear evidence of the depth at which the rocks were foliated, for the change took place where the ores were in the zone of fracture and the slates were in the zone of flow.

The bulletin contains some excellent illustrations of the microstructure of the ores. One of the most novel is of molybdenite ore from the Catherine Hill Mine. It is given to illustrate the author's view that the molybdenite was a primary constituent of the granite, and that the felspars floated in the liquid molybdenite; whereas the photograph, showing that the sulphide is permeating the large crystal of orthoclase and that a thin felspathic tongue with a disconnected end projects into the solid ore, rather indicates the secondary nature of the molybdenite.

J. W. G.

RECENT CONTRIBUTIONS TO THE STUDY OF HEREDITY.¹

(1) PROTOZOA have as yet played but little part in the literature of heredity, and there are even some writers who belittle and disparage the evidence afforded by this group of animals on the ground that there is in them no separation of germ-plasm from somato-plasm. On the other hand, Jennings and Bateson have pointed out the importance of following the behaviour of conjugating and dividing Protozoa, since at such phases of life the phenomena of heredity are seen in a simple form. It is now known that this simplicity is deceptive. The protozoan does not simply cleave into two daughter cells, but first of all absorbs certain organs of its body, and after dividing its substance between the two or more descendants, leaves to them the further task of reforming these lost organs and other parts afresh. Moreover, in such a way is the cleavage carried out that the regenerating parts required by each daughter cell are not optically sym-

¹ (1) "Euplotes Worcesteri II. Division." By L. E. Griffin. *Philippine Journal of Science*, Vol. v. No. 6, December, 1910. Pp. 322-337+5 plates.

(2) "Experiments with Drosophila Ampelophila concerning Evolution." By F. E. Lutz. Pp. iii+40. (Carnegie Institution, Washington: Publication No. 143, March, 1911.)

(3) "On Germinal Transplantation in Vertebrates." By Prof. W. E. Castle and J. C. Phillips. Pp. 26. (*Ibid.*: Publication No. 144, March, 1911.)

(4) "The Maturation of the Egg of the Mouse." By J. A. Long and E. L. Mark. Pp. iv+72+6 plates. (*Ibid.*: Publication No. 142, April, 1911.)

metrical. One may form a "head," the other a "tail," from what was the middle of the parental body. In other words, a dividing protozoan exhibits heredity under the form of alternate symmetry.

In the first paper on our list, this form of heredity is dealt with as fission. The particular animal studied is a species of *Euplotes*, a genus of ciliate infusoria commonly found on *Hydra*. Before division takes place, a new mouth is formed, independently of the existing one, by a depression of the ectoplasm, and a modification of its substance develops into a definite peristome. Meanwhile, the meganucleus elongates and becomes segmented into definite regions. The old cirri are gradually absorbed, and are replaced in the daughter cells by new structures. The author describes these changes in great detail, and promises another contribution upon the changes in *Euplotes* during conjugation.

(2) The pomace-fly, *Drosophila*, has been the subject of much recent investigation in America owing to its short life-history and the ease with which it breeds in captivity. The present paper, by Mr. F. E. Lutz, deals with the inheritance of abnormal venation in the wings of this fly. The facts, put very briefly, are that in wild specimens a few additional veins are occasionally, but rarely, met with, and the experimental evidence shows that in a large number of matings the percentages of such abnormally veined specimens are:—normal \times normal, 9.6 per cent.; abnormal ♂ \times normal ♀, 35.8 per cent.; normal ♂ \times abnormal ♀, 54.7 per cent.; abnormal ♂ \times abnormal ♀, 85.9 per cent. Discussing these remarkable increases in the ratio of abnormal to normal offspring, the author suggests that in all *Drosophila* gametes there is a factor tending to produce additional veins, but that its effects are often obscured, and only become visible in what may be called the upper part of its range. Especially interesting is the rise in the intensity of this factor when an abnormal strain is selected for breeding, and its rise and subsequent fall in a normal strain. Another point of importance is the observation that normally veined flies select normal mates when given a choice of both kinds. Mr. Lutz also gives a most interesting appendix on the question of disuse and degeneration of wings in this fly. *Drosophila* is a good flier, but when bred for forty generations under conditions that preclude the use of the wings, no degeneration or diminution in these organs can be detected. Altogether this is a very laborious and careful piece of research with bearings on many problems.

(3) The next two papers deal chiefly with the ovarian tissues of mammals. Much importance has been attributed to Guthrie's experiments on the transplantation of hen's eggs to foster-mothers of a different colour from that which produced the egg. According to this writer, the offspring of such foster-birds developed from the transplanted egg and were influenced by the foster herself. Davenport has recently denied both of these results, and now we have a contribution by Prof. Castle and Mr. Phillips upon similar experiments in guinea-pigs and rabbits. The results arrived at are not a little confusing. In the clearest case the procedure was as follows. The two ovaries of an albino were removed at intervals of a week, their places being taken by an ovary from each of two black sows of differing ancestry. After recovery, the albino foster-mother was put to an albino guinea-pig. Two hundred days later two ♀♀ were born, both of which were black with red hairs, and two months later one ♂ of the same colouring. Some three months afterwards the albino died of pneumonia, and was found pregnant with three full-grown ♂♂, again black and with red hairs interspersed. One of her daughters mated with the same albino ♂ threw two albinos and one black. A control mating between a pure black ♀ and the same albino ♂ gave five young, all of which were black with red hairs.

These results are held to show that the engrafted ovarian tissue was the source of the black young produced by this cross albino \times albino, and that no foster-mother influence could be detected. But, on the other hand, all the remaining cases go to show that, as in Davenport's fowls, extirpation of the ovary is not complete, and is followed by regeneration, the regenerated ovary being the source from which the young produced

during the experiment are derived. A review of recent work on this difficult subject is appended to this paper.

(4) The last paper on our list deals with the egg of the mouse. By most observers the egg of this animal has been regarded as an exception to the rule that two polar bodies are formed during maturation. In order to clear up this point and to settle many other doubtful features of this egg, Prof. Mark and Mr. Long have undertaken an elaborate research involving the examination of 1000 eggs from 147 mice. The methods employed are given in welcome detail, and a special feature of the apparatus was a balance and recording drum so arranged as to indicate automatically the time of parturition. The histological results show that all mouse-eggs form two spindles and a first polar cell, and that all eggs on coming into contact with spermatozoa form a second polar cell. With regard to details, the authors conclude that the number of chromosomes is twenty. The chromosomes of the first spindle are "tetrads," and show indications of both transverse and of longitudinal fission, whilst those of the second spindle are "dyads," and divide longitudinally. The work is most carefully executed, and is fully illustrated, but the cytoplasmic structures are scarcely visible in the plates. The paper is one of great value to embryologists.

THE AMERICAN PHILOSOPHICAL SOCIETY.

THE annual general meeting of the American Philosophical Society was held at Philadelphia on April 20-22, and more than sixty papers on scientific and literary topics were presented.

It has been the custom for several years to devote one half-day session to a symposium on some special subject in science. This year the afternoon of April 22 was devoted to this feature, the topic being modern views of matter and electricity; and the following papers were offered:—The fundamental principles, by Prof. D. F. Comstock, of Boston; radio-activity, by Prof. B. B. Boltwood, of New Haven; thermionics, by Prof. O. W. Richardson, of Princeton; the constitution of the atom, by Prof. H. A. Wilson, of Montreal. The general conclusion seems to be that the atom of matter, groups of which compose the molecules of different substances, is built up of much smaller parts, called electrons, identical with the smallest unit of negative electricity. It was also explained how it is possible to estimate the actual number of electrons in any particular atom. As the inertia of an electron emitted from an atom of a radio-active substance, such as radium, has been experimentally proved to be a function of its speed, the evidence is strong that all inertia or mass may be electrodynamic in its nature.

Physiology.

The secretion of the adrenal glands during emotional excitement, by Prof. W. B. Cannon, Harvard University. The adrenal glands and the sympathetic nervous system are intimately related. The sympathetic system innervates the glands, and the glands in turn secrete a substance that affects bodily structures precisely as the sympathetic system affects them. The sympathetic system is aroused to activity in states of emotional excitement. Examination of the blood of excited animals reveals the presence of adrenal secretion, which was not found in the blood before the excitement. Possibly the adrenal secretion continues the excited state. Possibly also the adrenal secretion caused by emotional disturbances has some of the effects produced by injection of the substance, such as glycosuria and atheroma of arteries. Indeed, two of the author's students, Shohl and Wright, have recently shown that glycosuria can be produced in the cat by fright. The suggestion, however, must be put to further experimental test.

Coagulation of the blood, by Prof. W. H. Howell, Johns Hopkins University. The theory of the coagulation of blood most commonly accepted at the present time holds that three of the four necessary factors in the process are present in the circulating blood, but that the fourth, which initiates the process in shed blood, is furnished by the tissues outside the blood or by the disintegration of corpuscular elements in the blood itself. This fourth factor

is an organic substance of the nature of a kinase, which, in conjunction with the calcium salts of the blood, serves to activate the prothrombin, also present in the blood, to thrombin. The thrombin then acts upon the fibrinogen and converts it to fibrin, which constitutes the essential phenomenon of clotting. In opposition to this theory, the author gave experimental evidence to show that in normal blood the fluidity is due to the constant presence of an antithrombin, and that in shed blood the tissue elements furnish a substance, thromboplastin, which neutralises the antithrombin, and thus allows clotting to take place. In the vertebrates below the mammals, the thromboplastin is furnished by the cells of the outside tissues, and without their cooperation clotting would not occur. In the mammals, thromboplastin is furnished by elements in the blood itself, the platelets, so that the blood may clot promptly without cooperation on the part of the outside tissues. In human beings, the condition known as hemophilia, in which there is delayed clotting and danger of fatal haemorrhage, the defect is due, not to a lack of kinase in the tissues as a whole, the view usually taught at present, but to an excess of the antithrombin normally present in the blood.

The cyclic changes in the mammalian ovary, by Leo Loeb, director of the Pathological Department, St. Louis Skin and Cancer Hospital. In the mammalian ovary cyclic changes of a very far-reaching character take place. They concern the follicles, corpora lutea, and ova. There exists in the ovary a mechanism (in the corpus luteum) regulating those changes; the corpus luteum prolongs the sexual cycle, not by retarding the maturation of the follicles, but by preventing the rupture of the mature follicles. The author's recent observations make it very probable that a partial parthenogenetic development of some ova accompany those cyclic changes in the follicles in a certain percentage of animals.

Electrical Engineering.

The high voltage corona in air, by Prof. J. B. Whitehead, Johns Hopkins University. The author described the limitation to the long-distance electrical transmission of power imposed by the insulating properties of the air, and a new method for determining accurately a voltage at which the air in the neighbourhood of electric wires and cables will break down, and also gave the results of a series of experiments on the influence of the size of the wire, the stranding of the wire into a cable, the frequency, the pressure, the temperature, and the moisture content of the air. He also reviewed the bearing of present physical knowledge on the nature of the phenomena which are involved.

Geology.

Supposed recent subsidence of the Atlantic coast, by Prof. D. W. Johnson, Harvard University. The author briefly reviewed the evidence in support of the generally accepted theory that the Atlantic coast is subsiding at the rate of from 1 to 2 feet per century, and showed that the phenomena supposed to indicate subsidence might be produced by fluctuations in the height of ordinary high tides resulting from changes in the form of the shore-line. A study of the Atlantic shore-line indicates that conditions are there favourable to marked local changes in the height of the tides, independently of any general movement of the land. On the other hand, the structure of certain beaches along the coast afford very strong proof that there can have been no long-continued progressive subsidence of the coast within the last few thousand years. The theory of fluctuating tidal heights, and the theory of stability of the land mass, were illustrated by selected examples of shore-line phenomena.

Alimentation of existing continental glaciers, by Prof. W. H. Hobbs, University of Michigan, Ann Arbor. It was in the Alps of Switzerland that the early studies, and by far the larger number of subsequent investigations, of glaciers have been made. The Swiss type of glacier is one of the most diminutive, but as the theory of former continental glaciation was derived from these studies of puny glaciers, it is not surprising that their attributes were carried over unchanged to the reconstructed extinct types thousands, and even tens of thousands, of times larger,